

30	8	72	9	108	6
31	6	73	9	109	7
32	17	74	6	110	6
34	6	75	6	111	6
35	5	76	12	112	9
36	6	77	10	113	8
37	7	78	4	115	16
38	11	79	4	116	10
39	5	80	14	117	9
40	14	81	14	118	19
41	11	82	4	119	13
42	11	83	4	120	21

DRAGONFLIES FROM THE WESTERN KIMBERLEY REGION

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INTRODUCTION

This paper provides a list of the dragonflies and damselflies (Odonata) collected during a five week visit to the west of the Kimberley region in April/May 1988. Information on habitats, local abundance, national distributions and some comments on the ecology and behaviour of some of the more interesting species are also presented. The visit was made between 7 April and 13 May 1988 as part of the Kimberley Research Project, an Anglo-Australian multi-disciplinary project designed to investigate aspects of the biology and geomorphology of the region. The study area contained parts of the Oscar, Napier and King Leopold Ranges and extended from Fitzroy Crossing (125° 32'E, 18° 11'S) in the south and east, to Lennard River/Gibb River Road (124° 45'E, 17° 24'S) in the west, and Beverley Springs (125° 28'E, 16° 43'S) in the north.

SPECIES AND DISTRIBUTIONS

A total of 32 species was collected, of which 14 were damselflies (Sub-Order Zygoptera) and 18 were dragonflies (Sub-Order Anisoptera). Table 1 lists the species and the habitat types from which they were collected, together with a rough index of abundance. Watson (1974) listed 53 species of odonates from the Kimberley region, and Watson (1977) added a further 4 species. Four species were collected which did not appear among the 57; they were *Agriocnemis argentea*, *Agriocnemis rubescens*, *Austroagrion pindrina* and *Austrosticta fieldi*. Of these, the first two have been recorded in the Kimberley region since 1977 (Dr. J.A.L. Watson, pers. comm.), but the third, *Austroagrion pindrina*, is the first record of this species outside the Pilbara region. A mating pair was collected in Brooking Gorge in the Oscar Range (125° 32'E, 18° 1'S) on 18 April. A long series of *Austrosticta* was collected. The specimens were essentially *A. fieldi*, but tended to bridge the

gap between this species (described from Tennant Creek, NT) and *A. soror*, described from the Kimberley. The series may help to resolve the status of the two names (Dr. J.A.L. Watson, pers. comm.). One further interesting distributional record was that of *Austrogomphus turneri*, single individuals of which were seen on two permanent streams in the King Leopold Range. This species is not uncommon in Northern Territory and parts of Queensland, but only two other specimens are known from the Kimberley region (Watson 1991).

Table 1. List of species collected in west Kimberley 7 April-13 May 1988 by habitat, together with a rough index of abundance: 1=very rare (< 5 individuals seen), 2=uncommon even in suitable habitat, 3=usually present in low numbers at suitable habitat, 4=fairly common in suitable habitat, 5=very common (includes some species present wherever there was freshwater).

	Permanent streams/ rivers	Riverine pools & lagoons	Ponds	Misc.
COENAGRIONIDAE				
<i>Agriocnemis argentea</i> Tillyard	2			
<i>A. pygmaea</i> (Rambur)			2	
<i>Argiocnemis rubescens</i> Selys	3	3		
<i>Austroagrion watsoni</i> Liefstinck	3			
<i>A. exclamationis</i> Campion	2	2		
<i>A. pindrina</i> Watson		1		
<i>Ischnura aurora</i> (Brauer)		4	4	
<i>Pseudagrion aureofrons</i> Tillyard		3		
<i>P. ignifer</i> Tillyard	3	2		
<i>P. microcephalum</i> (Rambur)	3			
ISOSTICTIDAE				
<i>Austrosticta fieldi</i> Sjøstedt	4			
PROTONEURIDAE				
<i>Nososticta kalumbum</i> Watson & Theischinger	4			
<i>N. liveringa</i> Watson & Theischinger	2	3		
LESTIDAE				
<i>Austrolestes insularis</i> Tillyard		2		
AESHNIDAE				
<i>Gynacantha</i> sp. 'n'				caves
<i>Hemianax papuensis</i> (Burmeister)		3	4	
GOMPHIDAE				
<i>Austrogomphus turneri</i> Martin	1			
CORDULIIDAE				
<i>Hemicordulia intermedia</i> (Selys)	4	4		
LIBELLULIDAE				
<i>Aethriamanta circumstigmata</i> Selys		2		
<i>Diplacodes bipunctata</i> (Bauer)		5	5	
<i>D. haematodes</i> (Burmeister)	5	5	4	
<i>Nannodiplax nuba</i> Brauer	5	4		
<i>Neurothemis stigmatizans</i> (Fabricius)		3		
<i>Orthetrum caledonicum</i> (Brauer)	5	5	5	
<i>O. migratum</i> Liefstinck	5			
<i>Pantala flavescens</i> (Fabricius)		4	5	

<i>Potamarcha congener</i> (Rambur)		2
<i>Rhodothemis lieftincki</i> Fraser	3	
<i>Rhyothemis braganza</i> Karsch	3	
<i>Trapezostigma loewii</i> (Kaup in Brauer)	4	5
<i>Urothemis aliena</i> Selys	2	
<i>Zyomma elgneri</i> Ris	2	2

The Kimberley region has one endemic damselfly, the protonetid *Nososticta kalumbunu*. This species was locally common in its preferred habitat of narrow, fast-flowing, permanent streams. *Nososticta liveringa* was also found in the region, occasionally along the same water courses as its congener. However, *N. liveringa* was invariably found in lagoons or very slow-moving waters. The two species were seen together on one occasion, basking in the early evening sunshine.

ECOLOGY AND BEHAVIOUR

The unnamed *Gynacantha* species referred to in Table 1 is common in overhangs from the west Kimberley through the Northern Territory to north Queensland (Watson 1974, 1977; Watson *et al.* 1991). Bailey & Richards (1975) reported taking the same species from caves in the Prince Regent River Reserve. They found it in large numbers through the day resting on cave ceilings. Nothing was known about the breeding sites of the species until two exuviae were found in Old Napier Downs Cave in a rimstone pool (Thompson 1989). It is not possible to be certain that the eggs were laid in this pool, or were washed in, but the larvae undoubtedly completed their development there, presumably feeding on the gammarid shrimps present. It is highly unlikely that *Gynacantha* sp. 'n' is an obligate cave breeder.

Nososticta kalumbunu is an unusual damselfly. Males occupy small (<1.5m diameter) territories along narrow streams and defend them against conspecifics. They exhibit courtship behaviour in which the brown patches on the wings of the males (*cf.* Watson & Theischinger 1984) are prominently displayed. The females oviposit in tandem and continue to do so throughout the oviposition bout. However, if the pair is undisturbed during oviposition, the male may leave the female to oviposit alone. Males that leave their partners risk losing paternity of the last of the current batch of eggs, but have the advantage of spending less time in tandem when they are more vulnerable to predators. They are also able to spend more time on territory and have the opportunity to attract more incoming females. This plasticity in oviposition behaviour has not previously been reported in damselflies.

Argiocnemis nubescens is also an unusual damselfly. Typical coenagrionid damselflies copulate for 20-30 min, then oviposit in tandem. Copulation is presumably lengthy in order that the male has the chance to remove sperm from the storage organs of the female before inserting his own (see Thompson 1988 for review). However, mean copulation time in *A. nubescens* was <3 min and the female oviposited alone in the stems of water lilies straight afterwards. The mating system of *A. nubescens* is not clear. It is possible that males are territorial (unusual in coenagrionids) and the female oviposits in the male's territory; this would account for the absence of contact-guarding during oviposition (males essentially defend the oviposition site not the female). Another possibility is that the penis morphology is different from that of other coenagrionid damselflies and

that it is more like the sperm-packing dragonflies. The reproductive biology of this species clearly warrants further study.

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A SURVEY OF THE TERRESTRIAL VERTEBRATE FAUNA OF MOUNT WALTON, WESTERN GOLDFIELDS, WESTERN AUSTRALIA

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INTRODUCTION

Between 26 November and 3 December, and 10-11 December 1988, terrestrial vertebrates were surveyed in an area north-east of Mt. Walton in